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Proceedings of the Green Sea Urchins Regional Advisory Process Maritimes Region

May 23-24 and 26, 2000
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

T.L. Marshall, Chairperson

Department of Fisheries and Oceans
Bedford Institute of Oceanography
PO Box 1006
Dartmouth, Nova Scotia
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August 2000

Canada

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FOREWORD

These Proceedings are a record of the submissions to and discussions at the Regional Green Sea Urchins Assessment Review meeting of May 23, 24 and 26, 2000. The purpose is to archive the activities and discussions of the meeting, including research recommendations, uncertainties and official minority opinions on status reports. As such, interpretations and opinions presented in this report may be factually incorrect or misleading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement has been reached. Therefore, only the Status Reports, which contain the consensus decisions of the meeting should be used as sources of information of the status of the resources assessed. Additionally, the short summaries of stock status presented in this proceedings should not be referenced. The Status Reports are usually supported by CSAS Research Documents which will be finalized from the working papers presented at the meeting.

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ABSTRACT

Peer review of the status and sustainability of the green sea urchin resources in Maritimes Region, Nova Scotia and South-West New Brunswick, was conducted at the Bedford Institute of Oceanography on May 23-24 and 26, 2000. Two working papers were reviewed and formed the basis a stock status reports for urchins in each of Nova Scotia and New Brunswick (Maritimes Region). A total of 16 individuals representing DFO, the Province of Nova Scotia, Canadian Wildlife Service, the University of Maine and Industry participated in various aspects of the review.

RÉSUMÉ

On a procédé à un examen par les pairs de l'état et de la viabilité des stocks d'oursin vert de la Nouvelle-Écosse et du sud-ouest du Nouveau-Brunswick, dans la Région des Maritimes, les 23, 24 et 26 mai 2000, à l'Institut océanographique de Bedford. Deux documents de travail étudiés à cette occasion ont formé la base de Rapports sur l'état des stocks d'oursin l'un pour la Nouvelle-Écosse et l'autre pour le Nouveau-Brunswick (Région des Maritimes). En tout, 16 personnes représentant le MPO, le gouvernement de la Nouvelle-Écosse, le Service canadien de la faune, l'Université du Maine et l'industrie ont participé aux divers volets de cet examen.

INTRODUCTION

A peer review of the status and sustainability of the green sea urchin resources in Maritimes Region, Nova Scotia and South-West New Brunswick, was convened at the Bedford Institute of Oceanography on May 23-24 and 26, 2000 and resulted in two stock status reports. These reports update stock status reports 96/130E and 96/131E released in October, 1997.

The Chairperson, Larry Marshall, welcomed participants (Appendix 1), several of whom attended as a result of the "Letter of Invitation" (Appendix 2a) issued by Resource Management Branch. The tentative agenda (Appendix 3) was reviewed and approved. Because most participants were unfamiliar with the RA Process, the Chair opened with an overhead presentation on background protocols and participants roles in the process. The remit (Appendix 4), was then addressed by contents of each of the two Working Papers (Appendix 5). External reviewers, Drs. Elner and Vadas had been invited by the principle authors to each review the two working papers. Drs. Miller and Robinson were asked by the Chair to be rapporteur for the discussion which followed each others presentation.

Substantive research recommendations arising from the documents, reviews and discussion were carried forward to the SSRs and are reproduced in Appendix 6. A co-author critique of both the New Brunswick and Nova Scotia urchin working papers by review-designates Elner and Vadas appears as Appendix 7. A minority report re: wording in the Nova Scotia Green Sea Urchin SSR by Industry Representatives Budreski and Craig is filed in Appendix 9a.

The schedule of events for May 23 were in accordance with the tentative agenda but the review and revision of draft stock status reports on May 24 extended the adjournment from the planned noon hour until supper hour. The external reviewers were committed to a 1:00 p.m. departure and were invited to complete their comments on the draft Stock Status Reports (SSRs) prior to that time. Revised SSRs were circulated on May 25 and resultant comments (some written: Appendix 8) were addressed May 26. Appendix 2b is the letter of invitation for the final review (the others were telephoned) and attendees on that date are footnoted in Appendix 1. Discussion at the May 26 and subsequent RAP editorial board, June 18, re: wording/ content in the Nova Scotia Green Sea Urchins SSR resulted in a substantive minority report (Appendix 9b) by principle scientist, R.J. Miller.

SOUTHWESTERN NEW BRUNSWICK

Working Paper: Robinson, S.M.C. 2000. Assessment of the fishery-related information for the green sea urchin, *Strongylocentrotus droebachiensis*, in LFA 36-38 south-western New Brunswick. DFO RAP Working Paper 2000/43.

Referees: Drs. R. Vadas and R. Elner

Rapporteur: R. Miller

Summary

- Landings peaked at 1900 t in 1996 and have decreased slightly.
- Biomass survey and aging last done in 1992-4. Current TACs based on 5% of those biomass estimates.
- Harvested biomass is old, slow growing, and with low recruitment.
- CPUE suggest no stock-related problems in LFA 36 (mainland).
- Drop in CPUE last two seasons in LFA 38 (Grand Manan) suggest stock decrease, perhaps quota should be decreased.
- Projections of production is not warranted, more research needed.

Issues

- Is survey depth same as fishing depth? Yes
- Resolution of area not precise. Log locations are general.
- How were the small sizes counted on the diver survey? Size freq. collect the first 100 animals encountered. No quadrats taken. Counts of animals on transects, no digging into substrate.

Einer critique

- How good is CPUE from catch per day? Logs probably not accurate for no. tows or no. bottom hours. Therefore went to catch per day. Draggers cull at sea, and discard urchins with low roe.
- Is there discard mortality from draggers? Unknown. 50% of tows completely discarded.
- Has gear type changed for dragging? Scallop to Green drags. Small differences in last several years.
- Five-yr. old surveys for biomass not new. Present estimate of 3-6% exploitation probably different after 5 yrs. of fishing? Agreed.
- Have you done yield-per-recruit or Leslie? No. Variable growth rate invalidates y/r.
- LFA 38 a mining operation because of poor recruitment, LFA 36 better recruitment. Manage 38 as a mining operation, 36 could be managed as a normal fishery? If size freq. the same as in 1995, agree with this operation. Needs new survey to see if there is still low recruitment on Grand Manan.
- No predictive capacity because of lack of data on settlement and pre-recruits and not enough data on growth by area? Agree, more research needed for predictive capacity. No support for research within Division.
- Little fishery impact and small fishery for size of resource. Experimentally manage at different exploitation rates and monitor for recruitment? OK, but industry may not be interested.

Vadas critique

- Likes precautionary approach of low exploitation rate in Bay of Fundy. Maine industry not interested in precautionary approach since ca.1992. Recommends biomass survey every 2 yrs. because stock can change that quickly.

- Observes that recruitment more regular on wave-exposed sites than sheltered sites. Recruitment highest in southern Maine. Recruitment now decreasing in southern Maine last 2 years. Possible recruit over-fishing? Robinson would put recruitment high on list of to-dos and also, identify if there are specific settlement sites and wonders why 100 X more settlement in S. Maine than N.B., and about same no. fishery recruits? Miller suggests that habitat carrying capacity for adults is similar.
- Where do larvae come from? Unknown but thought to be local.
- Can we believe either logs or sales slips? Many errors and sloppy recording, more than falsification. Miller notes that one of the landing data sets is consistently lower than the other.
- Harvesters need to provide better log data. Agreed.
- How about max. urchin size to conserve brood stock? Research has shown that a 50 mm urchin produces 1 million eggs, 75 mm 10 million eggs. In lab studies, higher gonad yields come from medium sized urchins.
- How would you characterize market roe quality? OK is 8-15% yield but don't know if quality has changed. Divers, think quality is increasing.
- Has there been a change in kelp cover since fishery started? Always less kelp on mainland than Grand Manan; there are no systematic surveys but no noticeable change.
- Is there any change in urchin population as a consequence of harvesting, e.g., growth rate, roe quality? Better recruitment at one monitoring site, Prescription Weir.
- Maine data shows a fast and slow growing morf? NB culture experiments show as well

Floor

- Recruitment: Budreski indicates that smaller urchins are in deeper water, large urchins on kelp line and asks if they settle that way? Vadas replies that small urchins do recruit in shallow water and don't move far. Budreski thinks all small urchins recruit from deeper water to shallow and Robinson sees small urchins at low tide mark.
- Exploitation rates: Jones asks what the exploitation rate is in Maine. Vadas suggests that it is probably unknown. Jones asks if 6% exploitation rate is sufficiently precautionary and an optimum level of harvest? Robinson indicates that there are no data to calculate optimum and that current advice is based on sustained vs. decreasing CPUE and sizes. Production per unit area of habitat is needed to optimize harvests.
- CPUE: Elner. notes that CPUE is a complex relationship between abundance and market acceptance, because of high discard rate. Could have been big recruitment but decrease in quality to give same CPUE. Therefore, more surveys needed for biomass estimates. Craig. notes that quality from same fisher changes year to year. Osborne notes that recruits possibly killed by dragging on Grand Manan.

Research recommendations

- Noted that growth rates, distribution and rates of movement needed for yield per recruit analyses. To improve CPUE data, better log book information and at-sea observations are needed on draggers catch, discards and landings. Long-term temperature records could

conceivably contribute to an understanding of variability in production/ recruitment. Productivity should be investigated on a per unit area basis.

NOVA SCOTIA

Working Paper: Miller, R.J., and S.C. Nolan. 2000. History and management of the Nova Scotian sea urchin fishery. DFO RAP Working Paper 2000/44.

Referees: Drs. R. Vadas and R. Elner

Rapporteur: S. Robinson

Summary

- Landings were less than 100 t from 1989-90 to 1992-93, ranged from 1000-1300 t from 1994-95 to 1998-99, but fell to 800 t in 1999-00.
- Disease is the biggest threat to the sea urchin stock. Since 1995 it has eliminated 10 to 100 times as many urchins as the fishery.
- The dive fishery is unlikely a threat to the biological sustainability of the urchin stock because of reproductive refuges in space and size.
- Resource status: A large resource in Cape Breton is nearly unexploited; Guysborough and Shelburne Counties have lost a significant portion of their stock to disease; Halifax, Lunenburg, and Queens Counties have lost all their stock to disease; the resource is probably small in Yarmouth, Annapolis, Kings, Hants, and Cumberland Counties; Digby county landings are expanding, the limits are unknown.
- Unlike many fisheries, catch per unit effort is not a good index of stock size because restricted zones give fishers the freedom to plan for near uniform harvest days.
- In most fisheries the unit for assessment and management is a ton of fish. In this fishery the focus has been on the fishing
  license and the fishing area needed to support a license.
- There are strong advantages to the restricted zone approach in this fishery. However, the correct sizing of zones remains an obstacle to achieving the potential of the restricted zone approach.
- Dockside monitoring has not provided adequate data on landed weight or fishing locations.
- Studies are needed on urchin movement, methods to predict spread of disease, and sustainability of select beds.
- Fishery expansion should be precautionary with the exception of areas likely to be impacted by disease in the near term.

Issues

- Sexual maturity can be as small as 10 mm for males and 17 mm for females.

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- Four types of management: classic stock-based fishery, hatchery release, habitat based, aquaculture.
- Cyclical stage between kelp dominated and barren ground; industry has to work to keep it in transitional stage.
- Alan Baker summarized relaying urchins from fronts to areas for enhancement: seems to work, urchins stay put, mortality of 15%, can also move kelp to urchins but disease has put an end to it for now.
- CPUE does not seem to track landings very well in NS (some in BC, BOF and California) but not clear-cut.
- Stock not likely to be recruit over-fished wrt size at maturity.

Elner critique

- Very data poor in fishery and two areas are quite different wrt data available.
- Predictability does not seem possible with present system.
- Disease seems to be the master of the system so how can fishery management policies really control if disease is two orders of magnitude higher?
- Maybe should harvest more so more revenue is maximized?
- Substantial DFO resources going onto quality management (surveys etc.) rather than just setting some quality targets. Perhaps better expenditure of resources to go to setting up extension educational programs. Let market forces prevail.
- While zones are innovative, the economic returns may not be as much as competitive fishery. There may be more data coming in later to either support or refute this.
- Should we put resources into surveys of ephemeral stocks due to disease? Perhaps a more crude technique would suffice.
- Annapolis & Yarmouth counties seem to be areas with no data. Perhaps industry can get involved.

Vadas critique

- This is a good experiment as urchin fisheries are crashing around the world.
- In Maine, there was not enough preliminary information to set a precautionary approach.
- Harvest the hell out of stocks prior to disease coming. Therefore, some predictability would be warranted.
- Needs to be major amount of biological information generated about populations and disease.
- There are sites around (Salt Cove Pond) that warm up so that temperature is not the cause.
- Some areas probably can sustain further exploitation and some may have to be re-divided as they are currently under-exploited.
- Dockside monitoring should be re-evaluated. Monthly sampling is not a good idea. Random sampling should be done and large sample should be done. Will allow for the standardization of data.
- There are no estimates of biomass in study so that comparisons can not be done between other areas or time frames. A baseline needs to be developed.

- Surveying of fronts implies behavior will not change and is predictable. This assumption may not be warranted.
- What are the dynamics of the amoebae? If the amoebae is not present year round, what does that imply for a wave theory of spread? If the bug is retained in the system, where does it reside? A hypothesis or two should be tested.

Floor

- Budreski notes that the field is relatively new, so the current method may not be the ultimate tool for assessment of the stock. Some areas may not be able to grow kelp as there are some areas with no urchins and no kelp. Perhaps the evaluation technique needs to be rethought. Die-off has confused the issue.
- Budreski notes that die off occurs in late summer, but few people harvest before die-off. Industry should harvest earlier. This can be dome by existing industry so therefore, we should have no new licenses. This will also affect the market due to the sporadic nature of supply. Miller indicates that there is no perfect measure but fronts are better than assumed. Budreski disagrees because of convoluted nature of the kelp line and there is not always urchins to cause a kelp line and Miller indicates that the previous situation is temporary in nature. Nolan noted that over 75% of fronts measured had commercial densities of sea urchins. They were seen from bucket observations.
- Craig indicated that if some people still have some product in the zones, they would stand to lose if the zones were opened up for early harvesting. Perhaps leave an escape area for others to get into.
- Vadas indicated that there is merit to maintaining an experiment through the tough times. If this is a manipulation, there it needs to maintained.
- Budreski asks if the ones that are left behind are carriers of the disease for next year?
- Jones asks if it is practical to set up a control in the zones wrt management approach (i.e., couple of approaches in different areas) and evaluate in over 2-3 years. Miller suggests that it may be difficult to predict disease. Jones notes that in Digby, TAC was set at 70%, and asks if it should it remain there or be changed. Miller suggests that fishers should be asked for their opinion and that they should be the ones to do the survey and provide the recommendations.
- Osborne notes that problems of fishery and indicators are eliminated with zones. There should be some more information generated though as topics tend to get blended. How to access resource can be separate from disease and should be based on science. There may be several solutions to the problem and that may be more objective.
- Budreski notes that predictability is important and that fishers try to spread the product over the entire season. Also need to have continuous work for divers (used to be 80 days and now down to 40 in 6 months). Baker indicates that one needs to harvest urchins before one can understand what is commercial densities. Osborne indicates that there is a need for a participation criteria that most agree with, hopefully objective with a number attached.
- Marshall asks what do we have to put on the table for managers to have the option of doing things differently?
- Jones asks what sort of methods should be brought in to the areas with no disease problems.

Research recommendations (From working paper)

- Maintain zones.
- Base future allocations on km of feeding front.
- Resize Shelburne and Guysborough or harvested so that potential mortalities from disease can be harvested. Experienced fishers can help develop.
- Better dockside monitoring records, more complete records are needed etc.
- Surveys in eastern Cape Breton could contribute to some expansion in the fishery.
- There is a need to do urchin movement studies.

Appendix 1. List of Participants. (Sea Urchin RAP, BIO, May 23– 24[1] and 26[2], 2000.)

Name	Affiliation/Address	Phone	Fax	E-mail
Larry Marshall[1, 2] (Chairman)	DFO, Science Branch, BIO PO Box 1006 Dartmouth, NS B2Y 4A2	902-426-3605	902-426-6814	MarshallL@mar.dfo-mpo.gc.ca
Allen R. Baker[1]	Urchin Harvester	902-499-2868	902-845-2148	
Paul Budreski[1]	SW Nova Sea Urchin Assoc.	902-423-7062	902-423-4646	Budreski@hfx.eastlink.ca
Mike Craig[1, 2]	Agent, Guysborough Co. Zone Holders Assoc.	902-463-2203	902-522-2106	
Bob Elner[1]	CWS, Environment Canada, Pacific & Yukon Region	604-940-4674	604-946-7022	Bob.Elner@ec.gc.ca
Anne Harrington[1]	DFO, SWNB Area Office, 203 Water St., St. Andrews, NB E5B 1B3	506-529-5850	506-529-5858	HarringtonA@dfo-mpo.gc.ca
Vic Heniss[1]	License Holder, Halifax Co., West	902-823-2360	902-823-3146	Heniss@ns.sympatico.ca
Chris Jones[1, 2]	DFO, Resource Manage. Br., Marine House, Dartmouth, NS	902-426-1782	902-426-9683	JonesC@mar.dfo-mpo.gc.ca
Robert Miller[1, 2]	DFO Science Branch, BIO PO Box 1006 Dartmouth, NS B2Y 4A2	902-426-8108	902-426-1862	Millerr@mar.dfo-mpo.gc.ca
Odette Murphy[1]	DFO Resource Manage Br., Marine House Dartmouth, NS			MurphyO@mar.dfo-mpo.gc.ca
Steve Nolan[1]	DFO Science Branch, BIO PO Box 1006 Dartmouth, NS B2Y 4A2	902-426-2928	902-426-1862	NolanS@mar dfo-mpo.gc.ca
Bruce Osborne[1, 2]	NS Dept. Fish. Aqua. Halifax, NS	902-424-0352	902-424-4671	OsbornBD@gov.ns.ca
Shawn Robinson[1]	DFO, Science Br., SABS St. Andrews, NB	506-529-8854	506-529-5862	RobinsonSM@mar.dfo-mpo.gc.ca
Ron Smith[1]	DFO Resource Managem. Br. Marine House, Dartmouth, NS	902-426-1727	902-426-9683	Ron.Smith@mar.dfo-mpo.gc.ca
Chris Theriault[1]	Digby Co. Licence holder	902-245-5542		
Bob Vadas[1]	Biol. Sciences, Univ. Maine, Orono, ME 04469	207-581-2974	207-581-2969	Vadas@maine.edu

Appendix 2a. Invitation Letters

Government of Canada / Gouvernement du Canada

RESOURCE MANAGEMENT BRANCH
DEPARTMENT OF FISHER ES & OCEANS
SCOTIA-FUNDY FISHERIES
176 Portland St., Marine House, 5th Floor
Dartmouth, Nova Scotia, Canada
Phone: (902)426-1782 / FAX: (902) 426-9683
E-Mail: JonesC@mar.dfo-mpo.gc.ca

Addressee/Destination: To. Dist. List	Facsimile Number:	Number of Pages to Follow: N/A
Sender: Chris Jones Senior Advisor	Facsimile Number: (902)426-9683	Date: 02 May 2000
Subject: Sea Urchin RAP		

MESSAGE:

This is to advise you that a Regional Assessment Process for sea urchins has been scheduled to occur May 23, and May 24, 2000, in Room 117 of the Fish Lab, Bedford Institute of Oceanography (BIO) Dartmouth, Nova Scotia.

The RAP will review all areas under exploitation in the Scotia-Fundy Region with the intent to provide scientific advice on the status of the bio-sustainability of the resource under the auspices of the "Precautionary Approach".

In addition, the RAP is expected to provide recommendations on the types of scientific data and scientific monitoring methodologies required to maintain compliance to the "Precautionary Approach".

Would you please confirm your intention to attend with Carole Hope;
Ph 902-426-5955
Fax 902-426-9683

Regards

Chris

cc. Dianne Geddes
RAP Co-ordination Office, BIO

Distribution List for SF Sea Urchin Advisory Committee Members			
Name	**Association**	**Area**	**Address/Fax/E-mail**
Robert Miller	DFO	Science	902 426-1862
Ian Marshall	DFO	Yarmouth Area Office	902-742-6893
Alex MacIsaac	DFO	Sydney Area Office	902-564-7398
Ann Harrington	DFO	SABS	506-529-5858
Shawn Robinson	DFO	SABS	506-529-5858
Bruce Osborne	Nova Scotia	Department of Fisheries and Aquaculture	Fax 424-4671
Ron Hebb	President	Guysborough County Zone Holder's Association	Fax 902-522-2106
Allen Baker	President	Halifax County Eastern Shore Sea Urchin Association	Fax 902-845-2148
Paul Budreski	Vice President	South West Nova Scotia Urchin Association	Fax 423-4646
Alex Michael	Cape Breton	Native Bands representative Fax 902-756-2060	PO Box 221, Whycocomagh, NS B0E 3M0
Dwayne Theriault	Digby Annapolis Kings	Independent Licence Holder Lisa@tartanet.ns.ca	East Ferry, Little River, Digby Co NS, B0V 1A0
William Burke	Cape Breton	Independent Licence Holder Fax 902-733-2292	PO Box 4, Baleine Rd., RR#1 Louisbourg, NS, B0A 1M0
Rick Murphy	President	Sea Urchin Buyers' Association	Fax 902 889-3531
Andy Schnare	Independent Buyer/Processor		Fax 902-228-2310
Vitolds Heniss	Halifax West	Independent Licence Holder	PO Box 806 RR#1 Tantallon, NS B0J 3J0
Joseph Johnson	LFA 36	New Brunswick Ph. 506-755-0669 Fax 506-755-6811	86 Route 772 Stuart Town, NB E5V 1J4
Paul Green	LFA 38	New Brunswick	114 Ingalls Head Rd Grand Manan, NB E5G 3G4

Appendix 2b. Invitation Letters

-----Original Message-----
From: Geddes, Dianne
Sent: May 26, 2000 11:28 AM
To: 'budreski@hfx.eastlink.ca'; 'OsbornBD@gov.ns.ca'; 'Vadas@maine.edu'; 'heniss@ns.sympatico.ca'; Bob Elner; Chris Jones; Larry Marshall; Robert Miller; Ron Smith; Shawn Robinson; Stephen Nolan
Cc: Sinclair, Michael
Subject: Reconvening of the assessment meeting on the Nova Scotia green sea urchin

The assessment meeting on Nova Scotia green sea urchin is being reconvened this afternoon to examine a few remaining contentious points in the draft SSR.

This has been set up as a teleconference so you can call in if you wish. (This teleconference/meeting will commence at 1:00 p.m. this afternoon) [added in follow-up].

Joining instructions follow:

To join, please dial 613-954-9003. You will be asked for a pass code which is 1060#. he reservation number in case you need it is 1085373 and the phone number of the teleconference operator is 1-800-226-6338 (you should not need these last two numbers). Individuals at BIO are asked to join us in the **6th floor boardroom of the Polaris Building** at BIO.

If you have questions, please call Larry Marshall directly - 902-426-3605.

Dianne Geddes

Dianne Geddes
RAP Secretariat/Secrétariat du PCR
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Appendix 3. Meeting Schedule

TENTATIVE AGENDA

Tuesday, 23 May

10:00- Introductions and Regional Advisory Process

10:20- SWNB, S. Robinson (rapporteur: R. Miller) 40 min max.
points of clarification (from the floor)
formal reviews (Elner & Vadas)
questions/discussion from the floor

12:30- *LUNCH*

13:30- NS, R. Miller (rapporteur: S. Robinson) 40 min max.
points of clarification (from the floor)
formal reviews (Elner & Vadas)
questions/discussion from the floor

15:00 *BREAK*

16:20- NS cont'd

17:00- advisement re: SSRs; adjournment.

Wednesday, 24 May

8:30- SWNB SSR

10:00- *BREAK*

10:30- NS SSR

12:30- adjournment

Appendix 4. Meeting Remits

From: Jones, Chris
Sent: April 27, 2000 4:13 PM
To: Geddes, Dianne
Subject: RAP Remit Re: Sea Urchin

The following is considered as the 'Management Remit' for the sea urchin RAP scheduled to convene May 23-24, 2000, BIO.

---

1. **A**. Through the application of the conservation principle "Precautionary Approach" what is the recommended long-term bio-sustainability of the sea urchin resource throughout LFA 36, LFA 38 respectively.

B. What types of data and scientific monitoring methodologies are recommended/required to enhance and maintain compliance to the "Precautionary Approach" for the management of sea urchin fisheries in these areas.

2. **A**. In applying the same 'Precautionary Approach" to the sea urchin fishery in the waters adjacent to Annapolis, Digby and Yarmouth Counties, what is the long-term bio-sustainability of the sea urchin resource in general and in particular the 'Passage Areas' along the Digby Neck.

B. What types of data/scientific monitoring methodologies are recommended /required to ensure compliance of the "Precautionary Approach" for the management of sea urchins in these areas

3. **A.** Similarly, what is the long-term bio-sustainability of the sea urchin resource adjacent to Shelburne, Queens, Lunenburg, Halifax, Guysborough, Richmond, Cape Breton and Victoria counties.

B. Given the fact that these areas have until now been managed through a unique area licencing system, what types of data/scientific methodologies are recommended to ensure compliance of the "Precautionary Approach" in the management of sea urchin fisheries in these areas.

Appendix 5. List of Documents Tabled

Miller, R.J., and S.C. Nolan. 2000. History and management of the Nova Scotian sea urchin fishery. DFO RAP Working Paper 2000/44.

Robinson, S.M.C. 2000. Assessment of the fishery-related information for the green sea urchin, *Strongylocentrotus droebachiensis*, in LFA 36-38 south-western New Brunswick. DFO RAP Working Paper 2000/43.

Appendix 6. List of Research Recommendations

New Brunswick Green Sea Urchins

- DFO needs to initiate a process with industry to develop methods for a plan to reduce the total allowable catch in LFA 38.
- Update the current biological information on the stocks currently being harvested as soon as possible, through surveys, an on-board observer program and experimentation.
- Action a strategy to develop the resource base required to manage this fishery. This may involve direct contributions from both DFO and local fishers through a JPA.
- The knowledge of the current stock status is partly limited by the present logbook program. Changes should be made to increase the accuracy and precision of this tool.
- More research should be done on: the relationship between catch composition relative to the CPUE; the possibility of recruitment over fishing; growth and recruitment of local populations; utility of local ocean data; and the existing biological conservation areas.

Nova Scotia Green Sea Urchins

The fishery is data poor in both biological and fishery information, and this impacts on the development of future management options. There is a need to improve information on the sustainability of the resource in harvested areas, the extent of the resource, and as well, develop a predictive capacity for the spread of disease and occurrence of die-offs. Specific requirements include:

- Improve accuracy of landed weights (including coding and verification) and fishing locations from the dock-side monitoring program.
- Increase industry participation in the DFO voluntary log program in order to obtain time series of harvests by bed within zones.
- Long term temperature data may be useful in addressing disease and growth issues.
- Measure the rate of urchin movement to and from feeding fronts.
- Delineation of refuges where the dynamics of urchin production might be investigated.
- Survey or conduct exploratory fishing on the east coast of Cape Breton Island and in the southern Bay of Fundy.
- Develop ability to forecast the occurrence and location of urchin die-offs from disease.

Appendix 7. Reviewers written comments.

Reviews of Working Papers, draft SSRs and Remit for the Green Sea Urchin (*Strongylocentrotus droebachiensis)* fisheries in Southwestern New Brunswick and Nova Scotia. by **Robert W. Elner,** Canadian Wildlife Service, Environment Canada, Pacific and Yukon Region, Delta, British Columbia and **Robert L. Vadas Snr.,** Department of Biological Sciences, University of Maine, Orono, Maine.

A. Issue

Given the establishment of sustained fisheries for green sea urchin in southwestern New Brunswick and Nova Scotia during the 1990's, fisheries managers have requested advice on the longer-term sustainability of the resources, the management approach and monitoring through the Regional Assessment Process (RAP). Accordingly, assessments have been carried out on both fisheries, based on historical and current landings and effort data from the fisheries, as well as research surveys. he following external reviewer comments on the assessment documents are a component of the RAP.

B. General Recommendations (No Order of Priority):

1. Fisheries basis (Elner and Vadas): The sea urchin fisheries in both southwestern New Brunswick and off Nova Scotia have, to-date, been managed conservatively through a precautionary approach. The "bottom line" is that the assessment data presented for both Provinces suggest that the resource is still largely under-exploited and close to (at) a virgin condition in some areas. Commercial exploitation appears sufficiently small, compared to the size of the resource base, and recent that the fishery has likely not yet had an impact on either the population structure, dynamics or distribution of the urchins, except in localized areas (as evidenced from CPUE and size frequency data). There may be merit to adopting an adaptive management approach in pilot areas; that is, fishing at a higher exploitation rate to test the resource responses. Potential benefits could be an increase in production (growth rates and recruitment) as intra-species competition is reduced. Risk to such an approach is low given the minimum legal size is considerably above that of biological maturity, the high fecundity of the species and, probable, extensive larval recruitment regime (plus see B#2, evidence that stocks recover rapidly from devastating disease).

2. Biological basis (Elner): The green sea urchin is an ubiquitous and abundant near-shore invertebrate widely distributed throughout boreal waters (hemispheric range). Fecundity is high and the size of maturity (approximately 25 mm test diameter) is well below the minimum legal size (50 mm test diameter). (Classic "*r*-selected" species). "Supply-side" recruitment seems evident for some stocks, with periodic or sporadic massive pulses of larval settlement and the recruits dominating the sub-tidal system for years. In some cases, the high densities of urchins create feeding fronts that destructively graze macroalgal beds before dispersing over extensive "barrens", largely devoid of macroalgae. These "barrens" can exist for periods ranging from years (Nova Scotia) to decades, perhaps centuries (Newfoundland). Annual recruitment is far lower in other stocks and sea urchins coexist with extensive macroalgal beds. Stock-recruitment relationships and the factors regulating recruitment processes are poorly understood. Growth

rates are controlled by temperature and food supply and vary greatly over the species range. Disease episodes, seemingly strongly correlated with temperature, are responsible for massive mortality in some areas (especially off Nova Scotia). Irrespective of the management approach, appreciation of the biology of the species suggests that the risk of recruit over-fishing appears low. Is growth over-fishing a concern/possible? Comparisons against other more intensive fisheries (especially the Gulf of Maine and British Columbia) for this same urchin species would be useful to further test the aforesaid.

3. Essential questions (Elner): 1) at what intensity (if any) does commercial exploitation have the potential to control these stocks? and/or 2) is the fishery always in a reactive role to more dominant abundance controlling natural factors (temperature, macroalgal availability and disease)?

4. Management Regimes (Vadas and Elner): The contrast between the management, exploitation standards and fisheries science/philosophy approaches for southwestern New Brunswick (N.B.) and Nova Scotia (NS) is immense (NS is from Venus while N.B. is from Mars?). The former appears a largely traditional benthic invertebrate fishery, while the latter is highly innovative and more akin to "husbandry". Notwithstanding that the diversity may be warranted, it would be useful in future RAP exercises to have a standardized approach to, at least, assessments in order to compare the efficacy of the regimes. Also, explicit management plans should be available, detailing the management goals and strategies for the various fisheries and the required monitoring, assessment and research needs. Definitions of "Sustainability" and "Precautionary Approach" may need to be reconsidered, given the biological context (see #2, above), and included in the management plans.

5. Predictive Capacity (Elner and Vadas): The assessments presented for both southwestern New Brunswick and Nova Scotia are based on landings and effort data from the fisheries, as well as research surveys, and provide some indication of trends and current stock status; however, there is no ability to forecast future trends. While the conservative, precautionary approach gives some insurance against resource-failure and ensures "sustainability" (but at the real risk of under-utilizing the resource), the lack of predictive understanding is a major barrier to more optimal, (sustained) exploitation of the resource (more fishers and increased benefits to Atlantic Canada). Development of a rudimentary forecasting capacity would probably not be difficult (utilizing combination of settlement plates, routine collection and analyses of size frequency distributions, temperature monitoring and research on growth) and, cost notwithstanding, is desirable.

6. Data Considerations (Vadas and Elner): The assessments presented for both southwestern New Brunswick and Nova Scotia are data poor, compared to most other Atlantic invertebrate fisheries. Future RAP exercises would benefit from both improved databases (at-sea observations, better landings statistics and improved logbooks could yield markedly more useful CPUE indices) and wider, more in-depth scrutiny using tools such yield-per-recruit and Leslie analyses. Also, access to and application of sea temperature data from long-term monitoring stations might be useful in addressing disease and growth questions in future assessments.

7. Quality Considerations (Elner and Vadas): DFO managers and researchers have taken regulatory initiatives to promote harvest quality in both southwestern New Brunswick (season

restrictions) and off Nova Scotia (through particularly complex imperatives for enhancements to restricted zones). There is a considerable cost to taxpayers in enforcing such regulations and conducting audits. Instead of DFO intervention, consideration might be given to letting market economics act to persuade fisheries that increasing product quality is in their own interest. The latter would operate rapidly given the competitive nature of the Atlantic fishery and reduced catch value would likely be more persuasive than regulations in optimizing catch quality. The costs saved in enforcement could be diverted to providing practical educational material on landing quality and more research.

8. Understanding and predicting disease (Vadas): Disease is recognized as the major threat to the Nova Scotian sea urchin stocks. Recent disease episodes have disrupted all of the harvesting schemes being utilized in this fishery. A concerted effort should be made to understand as many aspects of the disease cycle as possible. With or without this understanding, a serious attempt should be made to develop predictive models for impending disease. More specifically, an experimental methodology needs to be designed to test the residual or latent presence of the disease organism (Ho) versus the re-inoculation each year (Ho). This possible wild card is a serious problem which can impact negatively on landings, the harvest regimes, the socio-economic aims of the harvest regimes and, hence, the industry.

9. Philosophy of Restricted Zones (Vadas): Restricted zones are an innovative management approach and needs to be pursued further. In doing so, consideration should be given to "incentive schemes" if realignment of restricted zones takes place, especially where licensees have done or made significant enhancements of sites.

10. Logbooks and dockside sampling (Vadas): It is widely admitted that the present data gathering is insufficient and inadequate for management and stock assessment. We suggest that a more rigorous methodology be developed that encompasses "random" sampling elements on a weekly or bi-weekly time-frame. These data should be able to test hypotheses with a reasonable amount of power.

C. Comments and Recommendations on Green Sea Urchin Fisheries in Southwestern New Brunswick

1. There are inconsistencies between data provided in the text, tables and figures on landings, for example, in both the Stock Status Report and the RAP Working Paper. Also, is the minimum legal size 50mm or 51mm test diameter (both are presented)? What are "sanctions"?

2. Larval settlement and growth data are being obtained but there is no indication on how this potentially powerful (predictive) information will be used. Tracking pre-recruit cohorts and forecasting recruitment strength are prerequisites to more effective management (see B5, above).

3. Size frequency data indicate that LFA 36 has a large reservoir of pre-recruits while LFA 38 has approximately double the fishable biomass but experienced a lack of larval recruitment for several years. Notwithstanding the contrasting dynamics, both stocks have a similar management regime: a TAC (are these partitioned into boat quotas?) with exploitation rates set at 6.8% and 3.3% of fishable biomass, respectively. However, the fact is that LFA 38 seems essentially a

"mining operation" (but see "Prescription Weir" database) and there appears little biological rationale (apart from, possibly, maintaining brood stock) for limiting effort. Yield-per-recruit considerations alone would suggest that LFA 38 should be exploited at a far higher rate (plus there is the additional potential benefit of invoking positive density dependent effects). Similarly, the rationale for such a conservative (6.8%) exploitation rate on LFA 36, a stock with seemingly such good pre-recruitment potential needs to be explored/more explicit (again yield-per-recruit analyses would be useful here).

4. (IMPORTANT): The quality relationships in the fishery need to be much more explicit. In particular, the high discard rate from dragging is an additional source of mortality and landings do not reflect at-sea catch rates. This bias to the database and probable cause of waste needs to be addressed on an urgent basis.

5. (IMPORTANT): TAC's are based on biomass surveys from 5-6 years previous and given #4 (above) estimates of exploitation rate are likely spurious.

D. Comments and Recommendations on Green Sea Urchin Fisheries off Nova Scotia

1. (IMPORTANT): How can fisheries conservation philosophies apply in cases where the major factor determining resource size is disease? Given that estimates provided indicate that biomass losses to disease have been approximately two orders of magnitude greater than harvest, the rationale for a "precautionary approach" to management (on the pretext of stock sustainability) is redundant. Consideration should be given to increasing F given that M is likely going to claim the majority of urchins left on the grounds. (Again, yield-per-recruit analyses might be insightful here).

2. Catch size frequency data would be helpful in future assessments given the dearth of most other reliable quantitative catch or effort data.

3. While the notion of exclusive (restricted) zones based on front length appears a highly innovative socio-economic and anthropological experiment, the biological basis to the strategy remains uncertain. Are exclusive areas more productive/sustainable (and better value to the taxpayer/nation) than competitively fished areas? There could be existing data from control and experimental situations to test the latter.

4. To-date, most restricted zone allocations appear underutilized (note CPUE data) and enhancement efforts appear token. Could the initiative benefit from either increasing effective fishing effort within present zones or cutting restricted zones by, say, 50% and, thus, allowing more entries, allow better utilization of the resource base and make enhancement more practical? The danger of the present situation is that "ownership" of these large zones will be (is) seen as an investment rather than an opportunity. That is, while the present zones may avoid the medieval "tragedy of the commons" they might, in doing so, create the alternative medieval situation of "Sea Urchin *Barrons*" (cf barrens).

5. (The paradox of costly and exhaustive surveys in an ephemeral system). Considerable effort has been made by DFO and the Industry to measure sea urchin beds and allocate zones based on

the survey results. However, these data and the collection efforts are quickly wasted with disease and other temporal changes in urchin distribution. given this scenario, an alternative cruder and less costly means of delineating zones seems in order.

E. Management Remit Questions

1A. See C3 (above). LFA 36 bio- sustainable in the long-term under the current "precautionary approach" but LFA 38 is a "mining operation" unless there is more recruitment.

1B. As A6 (above), there is a need for size frequency data from the Nova Scotia fisheries and improved catch and effort information. Improved (voluntary?) logbooks and increased at-sea sampling are possible mechanisms to improved monitoring.

2A. There is no way to address the resource potential in the waters adjacent to Annapolis, Digby and Yarmouth Counties without further surveys. However, rather than DFO conducting these surveys, it could be that a pilot (exploratory) fishery could generate the data.

2B. see 1B (above)

3A. see comments under D.

3B. see 1B (above)

F. Background

Fisheries for green sea urchin in Atlantic Canada were intermittent and small-scale during the 1970's and 1980's but have become more sustained during the past 10 years. Both sexes of are harvested for their gonads. Average sea urchin landings during the 1990's were approximately 1,500 t/annum and 1,000t/annum for the fisheries in southwestern New Brunswick and Nova Scotia, respectively, with a combined peak of over 3,000 t in 1996/97. The fisheries are prosecuted by approximately fifty (50) active license holders using either drags or divers, for southwestern New Brunswick, or divers only in Nova Scotia. Management is achieved by controlling fishing effort, through, variously, a combination of a limited licensing system, drag size restrictions, a diver number per license limit, TAC's, seasons and restricted zones. The biological integrity of the resource is sustained through maintenance of a minimum size limit well above size at maturity. Monitoring is achieved, variously, through vessel logbooks (a condition of license in southwestern New Brunswick but voluntary in Nova Scotia), mandatory dock-side monitoring reports, and direct communications with fishers and buyers. Catch quality is managed by seasons, for southwestern New Brunswick, and promoting /regulating enhancement initiatives in Nova Scotia. In addition, Department of Fisheries and Oceans has conducted extensive surveys on the distribution and abundance of green sea urchins.

Appendix 8. Written comments

A. Review of second draft the Stock Status Report (SSR) for NB green sea urchins by **Chris Jones**, Senior Advisor, Resource Allocation Branch, DFO. provided to L. Marshall and S. Robinson, May 25, 2000.

Just completed reviewing the draft SSR, and have one minor and one major comment.

1. The minor comment stems from geographical references, i.e., Campobello island, and Deer Island, Passamaquoddy Bay, Lubec Narrows, Nantucket Island. My notes indicate we discussed this and it was (agreed?) that the enclosed map would have these areas identified. For anyone reading this from afar and didn't know the area it would be difficult to relate as to where the designation existed.

Recommended Solution: Include these areas on the map.

2. The major point relates to the 2nd para under 'Management Considerations' , "In LFA 38, the existing data from surveys, the logbook records and the observations of the local fishers do not support the status quo. This suggests a decrease in TAC should be considered and firmer management controls should be considered."

   The first paragraph under 'Recommendations reiterates more or less the same comments, " Initiate a process to develop a plan for the reduction in total allowable catch for LFA 38 area." While this recognition is welcome, there is no reference to what reduction in TAC should occur. The existing TAC was based on a certain data set, what relative changes have occurred to what degree in this fishery to support a recommended regulatory decline in catch? The suggestion to develop a plan to reduce catch is very helpful but it simply creates gridlock in the absence of a reference level, i.e., reduction of 10% or 50% of current catch levels, etc.

Recommended Solution. Inject wording to reflect a specific reduction level over a specific period of time.

B. Comments on second draft the Stock Status Report (SSR) for NS green sea urchins by **Chris Jones**, Senior Advisor, Resource Allocation Branch, DFO. provided to L. Marshall and R. Miller, May 26, 2000

1. In the summary there is no mention that the fishery is data poor nor what actions should be incorporated to alleviate this circumstance.
2. The third last summary point that DMP has not provided adequate data on landed weight or fishing locations is not supported by the document. This was discussed as a single occurrence in Cape Breton and perhaps understood to have occurred in a general sense. If current data systems have not provided adequate accuracy on catches then it should be explained in the SSR and solutions recommended to ameliorate the situation. These solutions should include

the use of audits, enhanced standards of accuracy, timeliness, and/or shifting the onus of responsibility for this to industry interests.

3. Under the heading 'The Fishery', there is a description of the '*Restricted zone regime*' but no explanation of the fact that there are open competitive fisheries in areas along the coasts of the counties of Cape Breton, Digby, and intermingled among the restricted zones along the east coast of Nova Scotia. The distinction and location should be included either in the 'The Fishery', or under 'Resource Status'.
4. The last sentence of the last paragraph of the 'The Fishery', " After a few years of successful fishing they may apply for a restricted zone if they wish", this sentence is unclear as to who they are and relates to licencing policy under certain circumstances in certain areas under certain conditions. Hence should not be included in a SSR.
5. The last sentence in 'Outlook', "the south coast of Cape Breton Island could support several more licences than those currently fishing" should relate to supporting *increased effort* with a rationale of why.
6. 'Management Considerations ', the 2nd para, appears inconsistent with the 1st para, and is in conflict with the mgmt approach just across the Bay of Fundy along SWNB.
7. Recommend it either be re-worded or eliminated.
8. There are no biological comments on the status of the competitive stocks along Digby nor what biological process should be applied to monitor or manage these stocks which now represent approx. 40% of the Nova Scotia landings.
9. Under the heading 'Recommendations', a recommendation discussed and agreed upon but not apparent but should be included: " Considering this fishery is data poor, all forms of data acquisition should be considered including the continued use of surveys, sampling, observers, and direct data entry.
10. Include the recommendation "All competitive fishery areas should be subject to a precautionary approach".
11. This recommendation should be seriously considered to be included; "the competitive fishery along Digby is fished in a similar manner as in SWND, the management of this fishery should be consistent with that applied in SW New Brunswick, i.e. catch quotas."

Appendix 9a. Minority Report.

Recorded by L. Marshall (Chairperson)

Industry Reps, Budreski and Craig, in particular, opposed the inclusion of the word "substantial" in the following paragraph on Resource Status- Nova Scotia Green Sea Urchins SSR C3-(2000):

Guysborough County: In 1999, detailed surveys measured the lengths and locations of under-managed feeding fronts in 10 restricted zones. 268.5 km of under-managed front were located, ranging from 2 to 65 km per zone. From previous surveys it is known that areas not included in zones contained additional harvestable resource. In the fall of 1999 mortality from disease occurred. However, the 1999-00 catch per day was similar to previous years and total landing were only down 30% from 1998-99. Given that sea urchins aggregate along fronts where fishing occurs, this infers that substantial resource remains. In addition, only half the coast was fished in 1999-00, and if these fished areas are representative of the unfished areas, this also implies there is a substantial resource.

The industry indicated that from their perspective there was insufficient evidence to quantify the resource to the degree indicated.

Appendix 9b. Minority Report.

Submitted by R.J. Miller re: Nova Scotia Green Sea Urchins SSR, 28 June, 2000

1. I disagree with the opening statement in the Recommendations section, "The fishery is data poor in both biological and fishery information, and this impacts on the development of future management options." There is quite good information on the fishery. Data on catch rates, fishing effort, and fishing locations are better than for many large and developed fisheries; the Nova Scotia urchin fishery is small and new. Conventional fisheries biological data (size frequency, age frequency, biomass, fishing mortality) were not collected because they were not required to support the management plan. A major strength of the plan is that these conventional data are not important. If Fisheries Management now, after 6 years, chooses a markedly different approach, it is unreasonable to expect data to have been collected to support it. In summary, in spite of small budgets, a useful management plan was developed and the required data were obtained year-after-year in a timely manner to support the plan.

2. The paragraph under "Resource Status" that reviews Guysborough County was discussed for over an hour in the RAP session and underwent several iterations. Changes substituted by the editorial committee are unclear to me or are incorrect. Because fishers and Fishery Management will expect the responsible scientist, not the editorial committee, to defend the statements, the words of the responsible scientist should be given weight.

3. The RAP session and editorial committee spent 13 hours editing a 7 page SSR. Peer reviewers were involved only about 1 hour. The remaining 12 hours was spent discussing the changes requested (demanded) by nonscientists and by scientists without knowledge of the fishery or the species fished. Producing five drafts of the SSR also required significant effort. Much of the exercise a waste of time and was incompatible with the intent of a science peer review.